

**2025/FYUG/ODD/SEM/
PHYDSC-201T/197**

FYUG Odd Semester Exam., 2025

PHYSICS

(3rd Semester)

Course No. : PHYDSC-201T

(Waves and Optics)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

Answer any two of the following questions :

2×2=4

- (a) What is collinear harmonic oscillation?
- (b) What do you mean by Lissajous figures?
- (c) Write the differential equation of wave motion.

Answer either [(a) and (b)] or [(c) and (d)] : 10

- (a) Derive the general mathematical expression for Lissajous figure. **5**

(2)

- (b) Determine the specific expression for Lissajous figure when the phase difference between the two SHMs is $\frac{\pi}{2}$ and $\frac{3\pi}{4}$.
- (c) Obtain the expression for pressure of a longitudinal wave.
- (d) Derive the expression for intensity of a progressive wave.

UNIT—II

3. Answer any two of the following questions:

- (a) What is transverse wave? Give one example. 2×2=4
- (b) Give one example each of a propagating wave and a stationary wave.
- (c) On what factors does velocity of longitudinal wave in a medium depend?

Answer either [(a) and (b)] or [(c) and (d)] :

- (a) A tension T develops in a string of linear density ρ . Obtain the expression for velocity of the plane progressive in the string.

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(3)

- (b) Distinguish between transverse wave and longitudinal wave. How does change in amplitude and phase happen between incident wave and reflected wave in case of fixed end and free end of a string producing stationary wave? 5

- (c) Explain analytically the formation of standing wave in a string fixed at one end and free at the other end. Hence show that only odd harmonics are present in such case. 5

- (d) Define phase velocity and group velocity, and obtain the relation between them. 5

UNIT—III

5. Answer any two of the following questions :

2×2=4

- (a) Write two different types of wavefront.
- (b) What do you mean by interference by division of wavefront? Give one example.
- (c) Why are Newton's rings circular?

(Turn Over)

(4)

6. Answer either [(a) and (b)] or [(c) and (d)] :
- (a) Describe Fresnel's biprism method of obtaining interference.
 - (b) How would you determine the wavelength of light with the Lloyd's mirror experiment?
 - (c) What is wavefront? Write two properties of it. What are the two classes of producing interference?
 - (d) Explain interference in thin film due to reflected light.

UNIT—IV

7. Answer any two of the following questions :

2×2=

- (a) What is the difference between interference and diffraction?
- (b) What is the principle of Michelson's interferometer?
- (c) A shift of 200 fringes is observed when the movable mirror in Michelson interferometer is shifted through 0.0589 nm. Find the wavelength of light used.

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(5)

8. Answer either [(a) and (b)] or [(c) and (d)] :
- (a) Explain how Michelson's interferometer be used to determine refractive index of a medium. What is visibility of fringes?

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- (b) Explain Fraunhofer's diffraction due to single slit.

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- (c) What is diffraction grating? What do you mean by grating element? Explain how diffraction due to a grating is different from diffraction due to a single slit.

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- (d) A grating has 1100 lines ruled on it. What is the difference between two wavelengths that just appeared resolved in the first order spectrum in the region of wavelength $\lambda = 660 \text{ nm}$? What do you mean by resolving power of a telescope?

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UNIT—V

9. Answer any two of the following questions :

2×2=4

- (a) Why are Fresnel's half-period zones so called?
- (b) What are the applications of zone plate?
- (c) The innermost half-period zone of a plate has a diameter of 0.5 mm. Determine the focal length of the zone plate, if the wavelength of the incident light is 3000 Å.

(Turn Over)

10. Answer either [(a) and (b)] or [(c) and (d)] :
- (a) Obtain the expression of the radii and area of Fresnel's half-period zones.
 - (b) Out of red light and violet light, in which case focal length of a zone plate will be more and why?
 - (c) What is holography? How is it different from conventional photographs?
 - (d) What is point source hologram? Write two applications of holography.
